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ABSTRACT

Registrants of college chemistry (Chem 103) whose permanent address indicated they lived in Maryland, Washington, D.C., or northern Virginia, were invited by letter to participate in a pre-course refresher consisting of listening to as many as seven audiotutorial tapes on the basic concepts and calculations of chemistry. Sixty-nine percent of those who chose to listen to at least one of the tapes earned a final course grade of A, B, or C, while only 57% of non-users received at least a C final grade. There were significant differences among groups in terms of academic persistence, persistence in good standing, and semester grade point averages, in each of the three semesters following the semester of intervention. The results suggest that offering college chemistry registrants an opportunity to listen to audiotutorial tapes on the basic concepts of chemistry prior to their taking the chemistry course is a highly effective way to help them do well both in chemistry and in general. (CW)

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AUDIOTUTORIAL TAPES AS AIDS TO COLLEGE CHEMISTRY REGISTRANTS

Research Report # 10 - 87

The Counseling Center Retention Study Group*

*Vivian Boyd, Steven Carstens, Patricia Hunt, Stanley Hunt, Thomas Magoon, Jean McDevitt, Brian McLaren, Arnold Spokane

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AUDIOTUTORIAL TAPES AS AN AID TO
COLLEGE CHEMISTRY ASSISTANTS
Summer Session 1970

The Counseling Center Retention Study Group*

*Vivian Boyd, Steven Carstens, Patricia Hunt,
Stanley Hunt, Thomas Magoon, Jean McDevitt,
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Audio-tutorial Tapes as Aids to College Chemistry Registrants

The Counseling Center Retention Study Group*

Research Report # 10 - 82

Summary

Registrants of college Chemistry (Chem 103) whose permanent address indicated they lived in Maryland, Washington, D.C., or northern Virginia, were invited by letter to participate in a pre-course refresher consisting of listening to as many as seven audio-tutorial tapes on the basic concepts and calculations of chemistry. Sixty-nine percent of those who chose to listen to at least one of the tapes earned a final course grade of A, B, or C, while only 51% of non-users received at least a C final grade. There were significant differences among groups in terms of academic persistence, persistence in good standing, and semester grade point averages, in each of the three semesters following the semester of intervention. The results suggest that offering college chemistry registrants an opportunity to listen to audiotutorial tapes on the basic concepts of chemistry prior to their taking the chemistry course is a highly effective way to help them do well both in chemistry and in general. We will continue the audio-tutorial tape intervention and attempt to broaden the group of students using the tapes.

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AUDIOTUTORIAL TAPES AS AIDS TO COLLEGE CHEMISTRY REGISTRANTS

The Counseling Center Retention Study Group*
The University of Maryland College Park

Required courses in the sciences and mathematics frequently pose stumbling blocks for college students seeking a bachelors degree in any of an array of university disciplines. Chemistry 103 is one such course. It is a required entry level course for a number of different majors at UMCP, and it consistently rpports a high rate of D, F, and W grades. This rate in the fall of 1982 was 39%; in the spring of 1983 it was 49%; and for a random sample of CHEM 103 registrants in the spring of 1984 the rate was 59%. Clearly Chem 103 plays a pivotal role in the career decisions and development of UMCP students.

Many students who earn a D, F, or W grade in CHEM 103 reenroll in the course a subsequent semester. For example, in the Spring 1984 CHEM 103 sample mentioned above, 29% were repeating the course after an unsuccessful earlier enrollment; another 18% subsequently enrolled in CHEM 103 in the fall of 1984; of these, 29% dropped the course during the schedule adjustment period.

To ascertain whether a pre-course refresher would be a beneficial intervention, the Retention Study Group (1986) sent a letter to a random sample of CHEM 103 preregistrants during the winter break before the beginning of Spring semester 1984. The letter was cosigned by a member of the University's Chemistry

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Department and by the director of the Counseling Center's Learning Assistance Service (LAS). The letter advised students of the availability of a set of audiotutorial tapes designed to reacquaint listeners with the basic concepts of chemistry. The letter also said that the tapes were located in the Learning Assistance Service for use during the month of January prior to the first day of spring semester classes. Of the 47 letter recipients, 12, or 25%, listened to at least one of the tapes before the beginning of class. Of the tape users, 58% earned a final grade of C or better in CHEM 103 as compared with 40% of the nonusers. Of the tape users we later telephoned for an evaluation of the tapes, 75% said they wished they had listened to more of the series then they had. On the basis of these results, we decided to replicate this study on a somewhat larger scale.

METHOD

In early January 1985 the Retention Study Group (RSG) sent a letter to 484 Spring 1985 CHEM 103 registrants whose permanent address was in Maryland, Washington D.C., or northern Virginia. The letter, signed by the associate chair of the Chemistry Department, suggested that the student read and give serious consideration to an enclosed brochure, prepared by RSG, which described the pivotal role that CHEM 103 plays in the career development of students. The brochure described the percentage of D, F, and W grades typically earned by students in Chem 103, emphasized the importance of keeping up in class right from the beginning, and advised the student of the availability of audiotutorial tapes in the Learning Assistance Service. The

brochure stated that the tapes could be used prior to the beginning of the Spring semester.

Seventy-six Chem 103 registrants whose permanent address zip code indicated that they lived beyond the defined area served as a nontreatment comparison group, and received no letter or descriptive brochure.

Outcome Variables

The particular point in time at which the criterion data are gathered is a consideration in the evaluation of retention interventions which use the criterion variables of subsequent enrollment and subsequent academic performance. Two notable points in time are (a) end of semester, and (b) the beginning of the (following) semester.

The end of semester index has the initial advantage of providing retention and performance data sooner both for program evaluation purposes and for designing possible additional intervention "boosters." Furthermore, being closer in time to the intervention, it reduces the chance of intervening confounding variables.

The beginning of the (following) semester index, particularly for interventions which take place during the spring semester, has the initial advantage of distinguishing attrition which occurs over the summer period from that which occurs during the following fall semester.

Regardless of which index is used, the criterion variables must be clearly defined and the criterion data should be collected in a manner consistent with the definitions. The

present study collected its criterion data at the end of each semester. Two outcome variables were studied to determine the effect of the intervention on subjects' retention rates:

1) Academic persistence, defined as having completed a given semester, or graduated.

2) Persistence in good standing, defined as having completed a given semester with no academic action taken as a result of that semester.

The final grade for Chem 103 and semester grade point averages were also examined. All data concerning registration status, academic action, and grade point averages, were obtained from University records.

Of the 484 students to [illegible] letter, 81 (17%) came to the LAS to listen to at least one of the tapes. There were no significant differences among tape users, tape nonusers, and the comparison group in terms of previous enrollment in Chem 103. The percentage of students [illegible] was 25% for tape users, 20% for tape nonusers, and 21% for the comparison group. Nor were there significant differences among the three groups in terms of first exam grade. The average first exam grade for tape users, tape nonusers and the comparison group, respectively, was 72, 70, and 69. However, as can be seen in Table 1, when compared to tape nonusers, and to the comparison group, tape users had a higher percent of final course grade of A, B, or C.

Table 1.

Chemistry 103 Final Grade by Group

	Group							
	Tape User			Tape Nonuser			Comparison	
Final Grade	n	%	ES(a)	n	%	ES	n	%
A, B or C	51	69	.32	121	56	-.03	35	57
D, F or W	23	31	.40	134	44	.02	26	43

chi square = 4.08 p = .13

(a) Effect size between experimental groups and the control group, calculated using probit analysis (Glass & Smith, 1980).

Table 2 shows that although there were no differences among the three groups in academic persistence rates for Spring 1985 semester, a significant difference appeared for Fall 1985 and for Spring 1986, with tape users persisting at much greater rates than either of the other two groups.

Table 2.

Academic Persistence Rates by Group

	Group							
	Tape User			Tape Nonuser			Comparison	
Semester	n	%	ES(a)	n	%	ES	n	%
initial n	81			403			76	
Spring '85	78	96	-.07	371	92	0	70	92
Fall '85(1)	69	85	.24	291	72	-.11	58	76
Spring '86(2)	66	82	.36	266	66	-.11	53	70
Fall '86	56	69	.17	222	56	-.11	46	60

(1) chi square = 6.84 $p < .05$
(2) chi square = 8.12 $p < .05$
(a) Effect size between experimental groups and the control group, using probit analysis (Glass & Smith, 1980).

On the variable 'persisted and in good standing', there was a significant difference among the three groups, for three semesters following the semester of intervention, as can be seen in Table 3.

Table 3.
Academic Persistence in Good Standing by Group

	Group							
	Tape User			Tape Nonuser			Comparison	
Semester	n	%	ES(a)	n	%	ES	n	%
initial n	81			403			76	
Spring '85(1)	65	80	.37	250	62	-.15	52	68
Fall '85(2)	58	72	.27	227	56	-.16	47	62
Spring '86(3)	60	74	.33	211	52	-.26	47	62
Fall '86	51	63	.33	197	49	-.02	38	50

(1) chi square = 10.8 $p < .05$
(2) chi square = 7.5 $p < .05$
(3) chi square = 15.5 $P < .001$
(a) Effect size between experimental groups and the control group, using probit analysis (Glass & Smith (1980).

As expected, for the semester just prior to intervention, there were no statistically significant differences among the three groups' grade point averages. However, their grade point averages for Spring 1985, and for Spring 1986, showed significant differences, as can be seen in Table 4.

Table 4.
Semester Grade Point Average by Group

	Group										
	Tape User				Tape Nonuser				Comparison		
Semester	n	X	S.D.	ES(a)	n	X	S.D.	ES	n	X	S.D.
F '84(pre)	76	2.5			383	2.2			69	2.3	
S '85(1)	70	2.4	.89	.13	320	2.1	.95	-.24	69	2.3	.78
F '85	68	2.4	.86	.08	287	2.2	.90	-.20	58	2.3	.78
S '86(2)	64	2.6	.75	.46	262	2.3	.98	-.07	52	2.3	.69
F '86	53	2.7	.84	.34	220	2.4	.87	-.04	42	2.4	.82

(1) F 3.78 with 2 degrees of freedom $p < .05$
(2) F 4.21 $p < .05$
(a) Effect size between the treatment groups and the control group, using Cohen's (1977) d calculated as Xe-Xc/SDc.

DISCUSSION

Clearly, students who listen to at least one audio-tutorial tape for Chemistry 103 outperform their peers who do not use the tapes. This robust advantage appeared in final course grade distributions (fewer D's, F's and W's), in overall GPA in the semester after intervention, in academic standing, and especially in our most rigorous outcome, persistence in good standing several semesters after the intervention. The differences were significant and the effect sizes were in the medium range (Cohen, 1977). Moreover, students who did not use the tapes had markedly worse performance than a random comparison group. The effects did fade somewhat after three or more semesters, and this fading

argues for a retention-related booster intervention to maintain positive effects over a longer period of time. Possibly the suggestion to students that this particular academic course material had been problematic for other UMCP students may have (1) given these students permission to better prepare themselves and (2) had a more general effect of encouraging them to prepare more systematically for all of their classes.

The treatment was inexpensive, and convenient both for the students and for the Learning Assistance Service. We had hoped that more than 1?% of the students contacted by our letter would use the audio-tutorial tapes. Marketing the availability of the tapes may attract a larger portion of registrants for Chemistry 103. The attractiveness of the tapes to students may well be enhanced by sharing, in a careful way, the success that students who use the tapes achieve. This should be done in a manner that acknowledges that self-selection may increase the effectiveness of the tapes - that is, the most highly motivated students use the tapes, and it is in part their motivation to do so that may account for the experimental effects found.

It is important to separate the effects of self-selection from treatment if the "real" effects of such interventions are to be ascertained. We do not know, of course, whether increased numbers of students who subsequently use the tapes will fare as well as our initial sample did. Always the optimists, we believe they will. We are wrestling with ways to handle motivation as a design problem by taking an unobtrusive measure of motivation derived from previous behaviors. Motivation can then be used as a blocking variable to determine its moderating effects. There is

evidence that motivation alone does not account for all treatment differences found in retention studies. Blanc, DeBuhr, and Martin (1983), for example, reported success in improving student performance and reducing attrition rates with a supplementary instruction program. Blanc et al. controlled for motivation in their study. The results showed no significant difference in retention rates between the motivated and non-motivated groups. The treatment had retention effects beyond those attributable to differences between motivated and not motivated subjects. Another finding of the Blanc study was that both high-risk and low-risk subjects volunteered to participate. These results suggest that the issues of volunteerism and motivation may not be as compelling as we suspected in assessing effects of retention interventions.

For the present time, we conclude that we have a highly successful chemtape intervention. We will continue the audio-tutorial tape intervention and attempt to broaden the group of students using the tapes.

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